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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/721,605	11/25/2003	Chih-Hao Wang	MXIC 1516-1	5625
22470	7590	07/14/2005	EXAMINER	
HAYNES BEFFEL & WOLFELD LLP P O BOX 366 HALF MOON BAY, CA 94019			KANG, DONGHEE	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 07/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	Application No. 10/721,605	Applicant(s) WANG ET AL.	
	Examiner Donghee Kang	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 09 May 2005.  
 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.  
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5-25, 27-49 and 51-73 is/are pending in the application.  
 4a) Of the above claim(s) 71-73 is/are withdrawn from consideration.  
 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
 6) ☒ Claim(s) 1-3, 5-25, 27-49 and 51-70 is/are rejected.  
 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) ☐ All b) ☐ Some \* c) ☐ None of:  
 1. ☐ Certified copies of the priority documents have been received.  
 2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
 \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)  
 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_.  
 4) ☐ Interview Summary (PTO-413)  
 Paper No(s)/Mail Date \_\_\_\_\_.  
 5) ☐ Notice of Informal Patent Application (PTO-152)  
 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 5-16, 19, 21, 23-25, 27-37, 40, 42-49, 52-61, 64, 66, & 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al. (US 2004/0009642) in view of Admitted Prior Art and Yao (US 2004/0203253).

Re claims 1, 5-8, 16 & 19, Yoo et al. teach a method for forming an ONO structure, comprising (Figs. 2-5):

providing an oxide-nitride film (212 & 214) on a surface of a substrate (200), the oxide-nitride film including a first oxide layer (212) over the substrate and a silicon nitride layer (214) over the first oxide layer (Fig.2); patterning the oxide-nitride film (Fig.3) to define bottom oxide and silicon nitride portions of an ONO stack on the substrate, the bottom oxide and silicon nitride portions (210') having exposed sidewalls and the silicon nitride portion having an exposed surface (see paragraph 0022); and exposing the exposed sidewalls and the exposed surface to an ambient containing a radical oxidizing agent (paragraph 0026), to form an oxide layer (219, Fig.4) on the exposed surface and sidewalls of the patterned silicon nitride portion and on the sidewalls of the patterned bottom oxide portion. See also paragraph 0012-0014 & 0021-0027. Yoo et al. teach using plasma or high-temperature wet oxidation to generate

Art Unit: 2811

oxygen radical. Yoo et al. do not teach performing an ISSG process to generate oxygen radical under heating temperature in a range about 700°C to about 1300 °C.

However, APA teaches using ISSG process to grow oxide layer on silicon or silicon nitride substrate. In the "ISSG" process, the substrate is heated to a temperature high enough to catalyze a reaction between an oxygen-containing gas and a hydrogen-containing gas to form oxygen radical. Then the reactive oxygen radical can effectively oxidize the silicon or silicon nitride on the substrate (See paragraph 0006 in the specification). Yao also teaches forming oxide layer on the silicon substrate and silicon nitride using ISSG procedure under 800~1000°C (See paragraph 0038). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute plasma or high-temperature wet oxidation with ISSG operation as taught by APA/Yao in Yoo's method to generate oxygen radical ...

Re claims 2-3, 24-25, & 48-49, Yoo et al. teach the radical oxidizing agent comprising O\* (paragraph 0026).

Re claims 9-15, 21, 30, 33-36, 40, 42-46, 54-60, 64, 66, & 68-70, Yoo et al. as modified by Yao teach heating the substrate to a temperature in a range about 700oC to about 1300oC, exposing the exposed sidewalls and the exposed surface to a mixture of O<sub>2</sub> and H<sub>2</sub> in a proportion in a range about 0.1% to about 40% at a pressure in a range about 7.5~14 torr. Yoo et al. as modified by Yao do not explicitly teach a specific pressure time and flow rate. It is an obvious matter of routine experimentation to find the optimal mixture and pressure time ranges.

Re claim 23, 27-29,31-32, 37, 47, 51-53, & 61, Yoo et al. as modified by Yao teach substantially the entire claimed method, as explained statement rejection of claim 1 above, except for an isolation to separate the substrate two regions. APA teaches in Fig.2 forming isolation region (204) in the substrate (202) to separate the substrate. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form isolation region in the substrate as taught by APA in the Yoo's method in order to provide separation region in the substrate.

3. Claims **17-18, 20, 22, 38-39, 41, 62-63, 65, 67** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al. in view of APA/Yao and further in view of Ikakura et al. (US 6,255,230).

Yoo et al. do not explicitly teach flowing the mixture of O<sub>2</sub> and H<sub>2</sub> further comprises flowing N<sub>2</sub> as a carrier gas. Ikakura et al. teach N<sub>2</sub> gas as a carrier gas (Col.9, lines 13-14). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use N<sub>2</sub> as a carrier gas since the carrier gas may help flowing an oxygen radical hence improving the oxide layer quality.

### ***Response to Arguments***

4. Applicant's arguments with respect to claims 1, 23, & 47 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 571-272-1656. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

Art Unit: 2811

you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Donghee Kang  
Primary Examiner  
Art Unit 2811

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